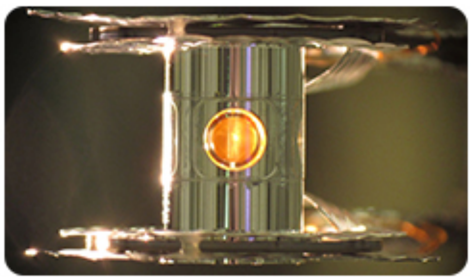
LIVERMORE LAB REPORT

A weekly review of scientific and technological achievements from Lawrence Livermore National Laboratory Feb. 17-21, 2014.

CBS THIS MORNING

ENERGY'S 'HOLY GRAIL'



A metallic case called a hohlraum holds the fuel capsule for NIF experiments. Livermore scientists recently achieved fuel gains. Photo by Eduard Dewald/LLNL

The National Ignition facility has a crossed a threshold that scientists have been grasping at for more than 50 years: achieving fuel gains greater than 1 on the path to fusion.

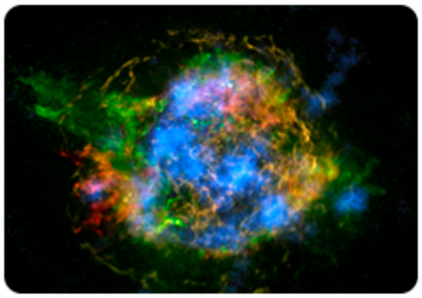
Ignition -- the process of releasing fusion energy equal to or greater than the amount of energy used to confine the fuel -- has long been considered the "holy grail" of inertial confinement fusion science.

A key step along the path to ignition is to have "fuel gains" greater than unity, where the energy generated through fusion reactions exceeds the amount of energy deposited into the fusion fuel.

Though ignition remains the ultimate goal, the milestone of achieving fuel gains greater than 1 has been reached for the first time ever at Lawrence Livermore's National Ignition Facility.

To see more, go *to CBS This Morning*.

CNN ASHES TO ASHES, DUST TO DUST



The NuSTAR high-energy X-ray observatory captured this image of Cassiopeia A, a remnant that blew up as a supernova more than 11,000 years ago, leaving a dense stellar corpse and its ejected remains.

Cassiopeia A was a star more than eight times the mass of our sun before it exploded in the cataclysmic, fiery death astronomers call a supernova.

And thanks to NuSTAR, a NASA space telescope, scientists are learning more than ever about exactly how it happened by producing the first map of the radioactive material from a supernova explosion.

Scientists used NuSTAR to see down the core of the explosion. "Cas A was a mystery for so long, but now with the map of radioactive material, we're getting a more complete picture of the core of the explosion," said Bill Craig, an LLNL scientist now at UC Berkeley and a member of the NuSTAR project.

To read more, go to *CNN*.

TIME USING GIANT LASERS TO PEER INTO PROTEINS

Beamline scientist Marc Messerschmidt loads a sample holder that supports two-dimensional protein crystals into the Linac Coherent Light Source at the SLAC National Accelerator Laboratory.

Lawrence Livermore scientists have used one of the world's most powerful lasers to understand proteins. Researchers have used the tool to unlock the secrets of a quarter of all known varieties of the organic matter, previously overlooked because of the difficulty in studying them.

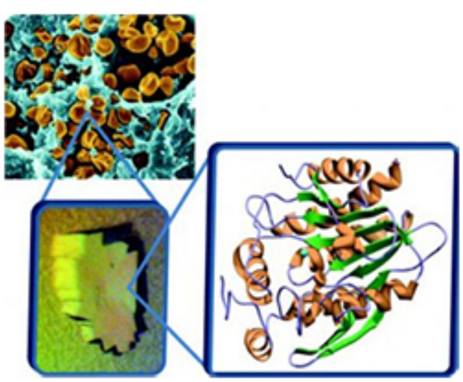
Insight into proteins helps in the development of new drugs, among many other things. The past century, however, their structures have been possible to determine only after the molecules have been stacked into a neat crystal.

"Our work demonstrates for the first time that two-dimensional protein X-ray crystallography is a potential method for obtaining protein structure information," said Matthias Frank, a physicist at Lawrence Livermore .

To read more, go to *Time Magazine*.

ScienceDaily
Your source for the latest research news

THAT WASCALLY WABBIT



The functions of novel proteins putatively involved in *F. tularensis* virulence are revealed by X-ray crystallography. Image courtesy of LLNL/G. K. Feld/CDC.

Tularemia, aka "rabbit fever," is endemic in the northeastern United States, and is considered to be a significant risk to biosecurity -- much like anthrax or smallpox -- because it already has been weaponized in various regions of the world.

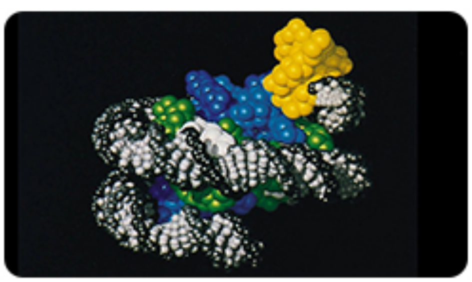
Geoffrey Feld, a postdoctoral researcher at Lawrence Livermore, describes his work to uncover the secrets of the bacterium *Francisella tularensis*, which causes tularemia.

"Despite its importance for both public health and biodefense, *F. tularensis* pathogenesis isn't entirely understood, nor do we fully understand how the organism persists in the environment," Feld said.

Previous efforts, funded by both the National Institutes of Health and LLNL, demonstrated that amoebae may serve as a potential reservoir for the bacteria in nature. "Specifically, we demonstrated that amoebae exposed to fully virulent *F. tularensis* rapidly form cysts -- dormant, metabolically inactive cells -- that allow the amoebae to survive unfavorable conditions," said Amy Rasley, the LLNL research team leader.

To read more, go to *Science Daily*.

TMCnet.com **A DO-IT-YOURSELF TOOL**



This DNA molecule is wrapped twice around a histone octamer, the major structural protein of chromosomes. New studies show they play a role in preserving biological memory when cells divide. Image courtesy of Memorial University of Newfoundland

A Lawrence Livermore physicist and his colleagues have found a new application for the tools and mathematics typically used in physics to help solve problems in biology.

Specifically, the team used statistical mechanics and mathematical modeling to shed light on something known as epigenetic memory -- how an organism can create a biological memory of some variable condition, such as quality of nutrition or temperature.

"The work highlights the interdisciplinary nature of modern molecular biology, in particular, how the tools and models from mathematics and physics can help clarify problems in biology," said Ken Kim, a LLNL physicist.

Not all characteristics of living organisms can be explained by their genes alone. Epigenetic processes react with great sensitivity to genes' immediate biochemical surroundings -- and further, they pass those reactions on to the next generation.

To read more, go to *TMC net*.
